National Aeronautics and Space Administration

Leading the Way Back to the Moon

Lunar Precursor Robotic Program

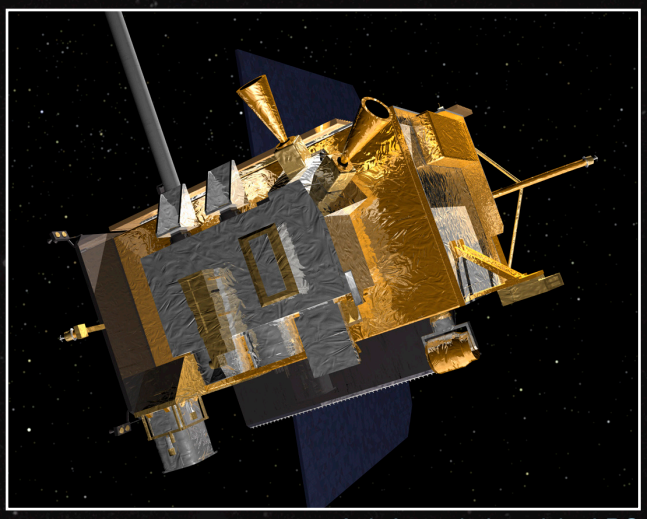
NASA's Lunar Precursor Robotic Program (LPRP) supports America's return to the Moon through robotic research missions that will pave the way for future human exploration. Robotic missions will allow us to test technologies, systems, flight operations, and exploration techniques to reduce the risk and increase the productivity of future missions, enabling sustained outposts on the Moon in preparation for human exploration of Mars and more distant destinations in the solar system.

Returning to the Moon

Building on the rich heritage of previous lunar missions, the LPRP missions will fill critical data gaps and significantly improve data accuracy, providing important information for mission planners. LPRP missions will gather data such as radiation levels in the lunar environment—important for reducing the risks of returning humans to the Moon. Surface imaging and mapping will aid landing site selection by identifying terrain hazards (slope, roughness, and obstacles) as well as areas of scientific and operational interest. Temperature and lighting conditions over an annual cycle, along with detailed characterizations of dust, environmental conditions, and radiation, are needed for mission and hardware design. Resource identification and mapping will inform decisions about possible future use of in situ resources on the Moon as we begin the journey to learn to live off-planet.

A Closer Look: Lunar Reconnaissance Orbiter

The Lunar Reconnaissance Orbiter (LRO) is the first step in our endeavor to create a comprehensive atlas of the Moon's features and resources. This robotic mission will provide data necessary to support the design of a lunar outpost. LRO data will assist with the selection of safe landing sites, the identification of lunar resources, and the study of how the lunar radiation environment will affect humans. Particular emphasis will be placed on investigating the polar regions of the Moon, where valuable resources for future outposts may exist in the form of continuous access to solar illumination and possible water ice in the permanently shadowed regions.



Artist's rendering of the LRO spacecraft, which is launching in 2008.

LRO is scheduled for launch in 2008, with a flight time to the Moon of approximately 4 days. LRO will assume a circular, polar orbit approximately 50 kilometers above the Moon's surface (a little more than 30 miles), closer than any other lunar mission. LRO will spend at least 1 year in low-polar orbit around the Moon, collecting the most detailed global data set gathered to date about the lunar environment.

Making an Impact: Lunar CRater Observation and Sensing Satellite

The Lunar CRater Observation and Sensing Satellite (LCROSS) mission, the second flight mission managed by LPRP, will search for water on the Moon. LCROSS will begin its trip to the Moon

Artist's rendering of LCROSS above the Moon's surface.

on the same Atlas V rocket as the LRO. The primary mission of LCROSS is to confirm the presence of water ice in the permanently shadowed craters at one of the Moon's poles. It will target one of the permanently shadowed craters in these regions, because it is in these low-temperature craters that we may find frozen water. After LRO separates from the launch vehicle for its own mission, LCROSS will use the spent Centaur upper-stage rocket as a 5,060-pound (2,300-kilogram) lunar impactor, targeting a permanently shadowed crater near one of the lunar poles. Asteroids and comets have left a lunar landscape of craters; this experiment, however, will analyze the moment of impact, when a >250-metric-ton plume of lunar ejecta rises above the Moon's surface. LCROSS will observe the plume of material with a suite of nine science instruments to look for water ice and examine lunar soil. The satellite will fly through the plume, also impacting the lunar surface. The impacts, which will excavate a 16-foot-deep crater approximately one-third the size of a football field, may be visible to a number of lunar orbiting satellites as well as Earth-based telescopes.

Mapping the Moon: The Lunar Mapping and Modeling Project

The LPRP's Lunar Mapping and Modeling Project will integrate new data from these missions, and potentially data from international missions, with existing information to develop highly detailed surface maps of topography and resource distribution. The project will also develop computer models of radiation and sunlight levels on the lunar surface.

By using information from historical missions, the upcoming LRO mission, and international lunar missions, tools will be developed to aid NASA's Constellation Program in planning for habitat development and location, power system development, resource utilization, and other engineering activities.

Managing Exploration

Marshall Space Flight Center's LPRP Office manages these pathfinding LRO and LCROSS missions and the Lunar Mapping and Modeling Project for NASA Headquarters' Exploration Systems Mission Directorate. Although the LPRP currently is part of NASA's Exploration Systems Mission Directorate, it will transition to the Science Mission Directorate in 2010. The Johns Hopkins University Applied Physics Laboratory (APL) and The Lunar and Planetary Institute are also participating in the education and public outreach efforts for the LPRP.

NASA Goddard Space Flight Center in Greenbelt, Md., manages the LRO project. Goddard will build the spacecraft; integrate instruments; and provide payload accommodations, mission systems engineering, assurance, and management.

NASA Ames Research Center oversees the development of the LCROSS mission with its spacecraft and integration partner Northrop Grumman. Ames is managing the mission, performing mission operations, and developing the payload instruments, and Northrop Grumman is designing and building the spacecraft for this innovative mission.

NASA Kennedy Space Center purchases the launch vehicle and manages the ground preparations for launch, including launch vehicle integration.

Leading the Way Back to the Moon

The LPRP is preparing the way for humankind's successful and productive return to the Moon by taking that crucial first step, providing strategic knowledge necessary to make informed, efficient, and cost-effective decisions for sustainable human lunar return. LPRP will create a foundation for future space exploration, thereby providing benefits to humankind and converting dreams into reality.

Join the Journey!

For more information on the Lunar Precursor Robotic Program, visit: http://moon.msfc.nasa.gov.

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Marshall Space Flight Center
Huntsville, AL 35812

www.nasa.gov

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